09/701255

525 Rec'd PCT/PTO 27 NOV 2000

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

REQUEST FOR FILING NATIONAL PHASE OF PCT APPLICATION UNDER 35 U.S.C. 371 AND 37 CFR 1.494 OR 1.495

To: Hon. Commissioner of Patents
Washington, D.C. 20231

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US)

Atty Dkt: PM 275350 /E4629-01MW
M# /Client Ref.

From: Pillsbury Madison & Sutro LLP, IP Group:

Date: November 27, 2000

This is a **REQUEST** for **FILING** a PCT/USA National Phase Application based on:

1. International Application	2. International Filing Date	3. Earliest Priority Date Claimed
PCT/JP99/02739	25 MAY 1999	28 MAY 1998
⇧ country code	Day MONTH Year	Day MONTH Year
		(use item 2 if no earlier priority)

4. Measured from the earliest priority date in item 3, this PCT/USA National Phase Application Request is being filed within:

(a) ☐ 20 months from above item 3 date (b) ☒ 30 months from above item 3 date,

(c) Therefore, the due date (unextendable) is November 28, 2000

5. Title of Invention PARTS IN EXHAUST SYSTEM AND METHOD OF PRODUCING THE SAME

6. Inventor(s) MORISHITA, Michio

Applicant herewith submits the following under 35 U.S.C. 371 to effect filing:

7. ☒ Please immediately start national examination procedures (35 U.S.C. 371 (f)).

8. ☐ **A copy of the International Application** as filed (35 U.S.C. 371(c)(2)) is transmitted herewith (file if in English but, if in foreign language, file only if not transmitted to PTO by the International Bureau) including:

a. ☐ Request;
b. ☐ Abstract;
c. _____ pgs. Spec. and Claims;
d. _____ sheet(s) Drawing which are ☐ informal ☐ formal of size ☐ A4 ☐ 11"

9. ☒ **A copy of the International Application has been transmitted by the International Bureau.**

10. **A translation of the International Application** into English (35 U.S.C. 371(c)(2))

a. ☒ is transmitted herewith including: (1) ☐ Request; (2) ☒ Abstract;
(3) 22 pgs. Spec. and Claims;
(4) 8 sheet(s) Drawing which are:
☐ informal ☒ formal of size ☒ A4 ☐ 11"

b. ☐ is not required, as the application was filed in English.

c. ☐ is not herewith, but will be filed when required by the forthcoming PTO Missing Requirements Notice per Rule 494(c) if box 4(a) is X'd or Rule 495(c) if box 4(b) is X'd.

d. ☐ Translation verification attached (not required now).

RE: USA National Filing of PCT /JP99/02739

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11. ☒ **PLEASE AMEND** the specification before its first line by inserting as a separate paragraph:
a. ☒ --This application is the national phase of international application PCT/JP99/02739 filed May 25, 1999 which designated the U.S.--
b. ☐ --This application also claims the benefit of U.S. Provisional Application No. 60/ _____, filed _____ .--

12. ☐ Amendments to the claims of the International Application **under PCT Article 19 (35 U.S.C. 371(c)(3)), i.e., before 18th month from first priority date above in item 3, are transmitted herewith (file only if in English) including:**

13. ☒ PCT Article 19 claim amendments (if any) have been transmitted by the International Bureau

14. ☐ Translation of the amendments to the claims **under PCT Article 19 (35 U.S.C. 371(c)(3)), i.e., of claim amendments** made before 18th month, **is attached (required by 20th month from the date in item 3 if box 4(a) above is X'd, or 30th month if box 4(b) is X'd, or else amendments will be considered canceled).**

15. **A declaration of the inventor** (35 U.S.C. 371(c)(4))
a. ☒ is submitted herewith ☒ Original ☐ Facsimile/Copy
b. ☐ is not herewith, but will be filed when required by the forthcoming PTO Missing Requirements Notice per Rule 494(c) if box 4(a) is X'd or Rule 495(c) if box 4(b) is X'd.

16. **An International Search Report (ISR):**
a. Was prepared by ☐ European Patent Office ☒ Japanese Patent Office ☐ Other
b. ☒ has been transmitted by the international Bureau to PTO.
c. ☒ copy herewith (2 pg(s).) ☐ plus Annex of family members (___ pg(s).).

17. **International Preliminary Examination Report** (IPER):
a. ☒ has been transmitted (if this letter is filed after 28 months from date in item 3) in English by the International Bureau with Annexes (if any) in original language.
b. ☐ copy herewith in English.
c.1 ☐ IPER Annex(es) in original language ("Annexes" are amendments made to claims/spec/drawings during Examination) including attached amended:
c.2 ☐ Specification/claim pages #_____ claims #
Dwg Sheets #
d. ☐ Translation of Annex(es) to IPER **(required by 30th month due date, or else annexed amendments will be considered canceled).**

18. **Information Disclosure Statement** including:
a. ☒ Attached Form PTO-1449 listing documents
b. ☒ Attached copies of documents listed on Form PTO-1449
c. ☒ A concise explanation of relevance of ISR references is given in the ISR.

19. ☒ **Assignment** document and Cover Sheet for recording are attached. Please mail the recorded assignment document back to the person whose signature, name and address appear at the end of this letter.

20. ☐ Copy of Power to IA agent.

21. ☐ **Drawings** (complete only if 8d or 10a(4) not completed): ___ sheet(s) per set: ☐ 1 set informal; ☐ Formal of size ☐ A4 ☐ 11"

22. Small Entity Status ⌀ ☒ is **Not** claimed ☐ is claimed (**pre**-filing confirmation required)
22(a) _____ (No.) Small Entity Statement(s) enclosed (since 9/8/00 Small Entity Statements(s) not essential to make claim)

23. **Priority** is hereby claimed under 35 U.S.C. 119/365 based on the priority claim and the certified copy, both filed in the International Application during the international stage based on the filing in (country) Japan of:

	Application No.	Filing Date		Application No.	Filing Date
(1)	10-146760	28 MAY 1998	(2)		
(3)			(4)		
(5)			(6)		

a. ☒ See Form PCT/IB/304 sent to US/DO with copy of priority documents. If copy has not been received, please proceed promptly to obtain same from the IB.
b. ☒ Copy of Form PCT/IB/304 attached.

RE: USA National Filing of PCT/JP99/02739

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24. Attached: Preliminary Amendment

25. **Preliminary Amendment:**

25.5 Per Item 17.c2, **cancel original** pages #_____, claims #_____, Drawing Sheets #

26. **Calculation of the U.S. National Fee (35 U.S.C. 371 (c)(1)) and other fees is as follows:**
Based on amended claim(s) per above item(s) ☐ 12, ☐ 14, ☐ 17, ☐ 25, ☐ 25.5 (hilite)

Total Effective Claims	4	minus 20 =	0	x $18/$9 =	$0	966/967
Independent Claims	2	minus 3 =	0	x $80/$40 =	$0	964/965
If any proper (ignore improper) Multiple Dependent claim is present,				add$270/$135	+0	968/969

BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(4)): →→ **BASIC FEE REQUIRED, NOW** →→→→

A. If country code letters in item 1 are **not** "US","BR","BB","TT","MX","IL" "NZ", "IN" or "ZA"

See item 16 re:

1. Search Report was not prepared by EPO or JPO	add$1000/$500		960/961
2. Search Report was prepared by EPO or JPO	add$860/$430	+860	970/971

SKIP B, C, D AND E UNLESS country code letters in item 1 are "US","BR","BB","TT","MX","IL", "NZ", "IN" or "ZA"

(X) ☐ B. If USPTO did not issue both International Search Report (ISR) and (if box 4(b) above is X'd) the International Examination Report (IPER),	add$970/$485	+0	960/961
(only) (one) ☐ C. If USPTO issued ISR but not IPER (or box 4(a) above is X'd),	add$710/$355	+0	958/959
(of) (these) (4) ☐ D. If USPTO issued IPER but IPER Sec. V boxes not all 3 YES, (boxes)	add$690/$345	+0	956/957
☐ E. If international preliminary examination fee was paid to USPTO and Rules 492(a)(4) and 496(b) satisfied (IPER Sec. V all 3 boxes YES for all claims),	add $100/$50	+0	962/963
27.	**SUBTOTAL =**	$860	
28. If Assignment box 19 above is X'd, add Assignment Recording fee of ----$40		+40	(581)
29. Attached is a check to cover the	**TOTAL FEES**	$900	

Our Deposit Account No. 03-3975
Our Order No. 11453 (C#) 275350 (M#)

CHARGE STATEMENT: The Commissioner is hereby authorized to charge any fee specifically authorized hereafter, or any missing or insufficient fee(s) filed, or asserted to be filed, or which should have been filed herewith or concerning any paper filed hereafter, and which may be required under Rules 16-18 and 492 (missing or insufficient fee only) now or hereafter relative to this application and the resulting Official document under Rule 20, or credit any overpayment, to our Account/Order Nos. shown above for which purpose a duplicate copy of this sheet is attached.
This CHARGE STATEMENT does not authorize charge of the issue fee until/unless an issue fee transmittal form is filed

Pillsbury Madison & Sutro LLP
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NOTE: File in duplicate with 2 postcard receipts (PAT-103) & attachments.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re PATENT APPLICATION of

MORISHITA, Michio

Appln. No.: New application Atty. Dkt.: 275350

Examiner: (unassigned)

Filed: Herewith Group Art Unit: (unassigned)

FOR: PARTS IN EXHAUST SYSTEM AND METHOD OF PRODUCING THE SAME

November 27, 2000

PRELIMINARY AMENDMENT

Hon. Asst. Commissioner
Of Patents
Washington, D.C. 20231

Sir:

Please amendment this application as follows:

IN THE CLAIMS:

Please cancel claims 1-4 in favor of the following replacement claims 5-8.

5. Parts in an exhaust system comprising:

an inner pipe formed from a cylindrical pipe, containing a catalyst carrier in a center portion and having substantially taper-like reduced diameter portions integrally formed in both end portions of the center portion; and

an outer pipe formed from a cylindrical pipe, having substantially taper-like reduced diameter portions integrally formed in both end portions of a center portion fitted on the center portion of said inner pipe and provided on an outer

periphery of the inner pipe in such a manner as to have a gap between the outer pipe and said inner pipe all along an area including the reduced diameter portions in both end portions,

wherein the reduced diameter portions in both end portions of said outer pipe are formed in accordance with a spinning process, and an inner surface of a front end portion thereof is closely attached to an outer surface of the inner pipe or an interposed material.

6. Parts in an exhaust system as claimed in claim 5, wherein one of a heat insulating member and a damper member is interposed as the interposed material in at least a part within said gap.

7. A method of producing parts in an exhaust system comprising:

fitting an outer pipe on an outer side of an inner pipe formed from a cylindrical pipe, containing a catalyst carrier in a center portion and having substantially taper-like reduced diameter portions formed in both end portions of the center portion with holding a gap therebetween; and

applying a spinning process in such a manner as to have a gap between both end portions of the outer pipe and the reduced diameter portion in said inner pipe so as to compress both end portions of the outer pipe in a substantially taper shape, thereby closely attaching an inner surface of a front end portion thereof to an outer surface of the inner pipe or an interposed material.

8. A method of producing parts in an exhaust system as claimed in claim 7, wherein one of a heat insulating member and a damper member is inter-posed as the interposed material

in at least a part between the inner pipe and the outer pipe at a time of fitting said outer pipe on the inner pipe.

REMARKS

These new claims 5-8 are the claims that were filed in the International Application and considered in the International Preliminary Examination Report.

Some of the enclosed documents listed on the enclosed form PTO-1449 were cited in the International Search Report, copy enclosed. Please return a copy of that form with the Examiner's initials adjacent to each citation.

An early and favorable action on the merits is earnestly solicited.

PILLSBURY, MADISON & SUTRO LLP

By _____

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APPLICATION UNDER UNITED STATES PATENT LAWS

Atty. Dkt. No. PM 275350
(M#)

Invention: PARTS IN EXHAUST SYSTEM AND METHOD OF PRODUCING THE SAME

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This is a:

- ☐ Provisional Application
- ☐ Regular Utility Application
- ☐ Continuing Application
  - ☒ The contents of the parent are incorporated by reference
- ☒ PCT National Phase Application
- ☐ Design Application
- ☐ Reissue Application
- ☐ Plant Application
- ☐ Substitute Specification
  Sub. Spec Filed _____
  in App. No. _____ / _____
- ☐ Marked up Specification re
  Sub. Spec. filed _____
  In App. No _____ / _____

SPECIFICATION

DESCRIPTION

PARTS IN EXHAUST SYSTEM AND METHOD OF PRODUCING THE SAME

TECHNICAL FIELD

The present invention relates to parts in an exhaust system and a method of producing the parts.

BACKGROUND ART

In parts in an exhaust system such as a muffler, a catalyst converter and the like of an internal combustion engine, there is frequently employed a heat insulating double structure in which an inner pipe having both end portions reduced so as to be formed in a taper shape and an outer pipe having both end portions reduced so as to be formed in a taper shape are arranged with an air gap therebetween.

For example, as shown in Fig. 8, there is a catalyst converter in which a metal outer pipe 105 having taper-like reduced diameter portions 104 at both end portions is arranged on an outer periphery of a metal inner pipe 103 containing a catalyst carrier 101 and having taper-like reduced diameter portions 102 at both end portions so as to provide a gap 106 between the inner pipe 103 and the outer pipe 105. In this structure, a light off characteristic of a catalyst is improved by a heat insulating effect of the gap 106 and

an exhaust gas purifying performance is improved. A catalyst converter having the structure mentioned above is, for example, disclosed in Japanese Patent Unexamined Publication No. 6-101465.

However, it is impossible to insert the inner pipe 103 structured such as to be expanded in a diametrical direction at a middle portion and have the reduced diameter portions 102 at both end portions into the outer pipe 105 expanded in a diametrical direction at a middle portion and having the reduced diameter portions 104 at both end portions so as to assemble them.

Accordingly, as a method of producing the double pipe mentioned above, there can be employed a general producing method comprising the steps of forming outer pipes having a shape reduced at both end portions in a hollow shape and in a double-split manner in an axial direction of the pipe, arranging them on an outside of a previously formed inner pipe while holding a gap between the inner pipe and the outer pipes, and bonding the outer pipes formed in the double-split manner to each other by a welding or the like. However, in the producing method, there is a problem that a cost is increased due to pressing dies, a welding process or the like.

In order to solve the problem mentioned above, for example, as shown in Fig. 9, there is a catalyst converter structured such that a large-

diameter portion 202 is formed in one end portion of the inner pipe 201, a small-diameter portion 204 is formed in an end portion of the outer pipe 203 opposing to the large-diameter portion 202 of the inner pipe, and the inner and outer pipes 201 and 203 are fitted to each other so as to bring the large-diameter portion 202 and the outer pipe 203 into contact with each other and bring the small-diameter portion 204 and the inner pipe 201 into contact with each other, thereby holding the gap 205 between the inner and outer pipes 201 and 203. This structure is disclosed, for example, in Japanese Patent Unexamined Publication No. 9-108576.

In the catalyst converter mentioned above, since it is necessary to provide the taper-like reduced diameter portions in both end portions thereof, taper-like diffusers 206 and 207 are provided in both ends of the structure obtained by combining the inner and outer pipes, in the structure shown in Fig. 9.

This is because it is necessary to connect an independent diffuser since the reduced diameter portions can not be previously formed in and fitted to both ends of the inner and outer pipes.

Accordingly, in this structure, the gap 205 can be formed only between the inner pipe 201 and the outer pipe 203 where the catalyst carrier 208 exists, and no gap can be formed in the taper portions (diffuser portions) of both end portions. Further, since the inner and outer pipes 201 and 203 are bonded

in the portion near the catalyst carrier 208, a heat transmission is performed in the portion near the catalyst carrier.

Accordingly, in comparison with the catalyst converter having the gap 106 extending to both of the taper-like reduced diameter portions 102 and 104, as shown in Fig. 8, the catalyst converter shown in Fig. 9 has a low heat insulating effect and an expected heat insulating effect can not be obtained, so that it is difficult to reduce a time required for activation of the catalyst.

DISCLOSURE OF THE INVENTION

Accordingly, an object of the present invention is to provide parts in an exhaust system in which a gap is formed in series to both of taper-like reduced diameter portions of inner and outer pipes as shown in Fig. 8 mentioned above, and a method of easily and inexpensively producing the parts in the exhaust system.

In order to achieve the object mentioned above, in accordance with the present invention, there is provided parts in an exhaust system comprising:

an inner pipe containing a catalyst carrier in a center portion and having substantially taper-like reduced diameter portions formed in both end portions of the center portion; and

an outer pipe having substantially taper-like

reduced diameter portions integrally formed in both end portions of a center portion corresponding to the center portion of the inner pipe and provided on an outer periphery of the inner pipe in such a manner as to have a gap between the outer pipe and the inner pipe all over the area including the reduced diameter portions in both end portions and the center portion,

wherein the reduced diameter portions in both end portions of the outer pipe are formed in accordance with a spinning process.

Further, in the parts in the exhaust system in accordance with the present invention, the structure may be made such that a heat insulating member or a damper member is interposed in at least a part within the gap.

Further, in accordance with the present invention, there is provided a method of producing parts in an exhaust system comprising the steps of:

fitting an outer pipe on an outer side of an inner pipe containing a catalyst carrier in a center portion and having substantially taper-like reduced diameter portions formed in both end portions of the center portion while holding a gap between the outer pipe and the inner pipe; and

applying a spinning process in such a manner as to have a gap between both end portions of the outer pipe and the reduced diameter portion in the inner pipe so as to reduce both end portions of the outer pipe in

a substantially taper shape.

Further, in the method of producing the parts in the exhaust system in accordance with the present invention, the structure may be made such that a heat insulating member or a damper member is interposed in at least a part between the inner pipe and the outer pipe at said step of fitting the outer pipe.

BRIEF DESCRIPTION OF THE DRAWINGS

Figs. 1A and 1B show an embodiment of parts in an exhaust system in accordance with the present invention, in which Fig. 1A is a vertical cross sectional view of the same and Fig. 1B is a cross sectional view taken along a line 1B-1B in Fig. 1A;

Figs. 2A to 2D are cross sectional views which show an embodiment of producing steps in accordance with the present invention;

Figs. 3A to 3D are cross sectional views which show another embodiment of producing steps in accordance with the present invention;

Figs. 4A to 4E are cross sectional views which show the other embodiment of producing steps in accordance with the present invention;

Fig. 5 is a partly enlarged cross sectional view which shows another example of an interposed state of a damper member in an embodiment according to the present invention;

Figs. 6A to 6C are cross sectional views

which show the other embodiment of producing steps in accordance with the present invention;

Figs. 7A to 7C are cross sectional views which show the other embodiment of producing steps in accordance with the present invention;

Fig. 8 is a vertical cross sectional view which shows a structure of a conventional catalyst converter; and

Fig. 9 is a vertical cross sectional view which shows a structure of another conventional catalyst converter.

BEST MODE FOR CARRYING OUT THE INVENTION

A description will be given of embodiments in accordance with the present invention on the basis of an embodiment shown in Figs. 1A to 7C.

Figs. 1A, 1B and 2A to 2D show a first embodiment in which the present invention is applied to a catalyst converter. Figs. 1A and 1B are vertical cross sectional views of the catalyst converter in accordance with the present invention. A center portion 1a of a metal inner pipe 1 is formed in a circular pipe shape, and a catalyst carrier 2 is inserted and received within the center portion 1a. Substantially taper-like reduced diameter portions (cone portions) 1b and 1c in which a pipe wall of the inner pipe 1 is inward deformed are integrally formed in both end portions of the inner pipe 1, and

cylindrical connection portions 1d and 1e are integrally formed in front portions of both of the reduced diameter portions 1b and 1c.

An outer pipe 3 having a cylindrical center portion 3a with a diameter larger than the center portion 1a of the inner pipe 1 is fitted on an outer side of the inner pipe 1, and a center gap 4 is formed between both of the center portions 1a and 3a.

Both end portions in the outer pipe 3, that is, the portions corresponding to the outer peripheries of the reduced diameter portions 1b and 1c in the inner pipe 1 are integrally formed in such a manner as to construct inward deformed substantially taper-like reduced diameter portions (cone portions) 3b and 3c, and cylindrical connection portions 3d and 3e reduced so as to be close attached to the outer periphery of the connection portions 1d and 1e of the inner pipe 1 are integrally formed in front portions of both of the reduced diameter portions 3b and 3c.

Tapered side gaps 4a and 4a formed so that an interval of the gap is made narrower as moving toward the front end portion are formed between the taper-like reduced diameter portions 1b and 1c of the inner pipe 1 and the taper-like reduced diameter portions 3b and 3c of the outer pipe 3, and both of the side gaps 4a and 4a are formed in series with the center gap 4.

A heating insulating member 5 is received within the center gap 4, and the heat insulating member

5 is held between the inner and outer pipes 1 and 3.

Next, a description will be given of a method of producing the catalyst converter shown in Figs. 1A and 1B with reference to Figs. 2A to 2D.

At first, the catalyst converter 2 is inserted into the cylindrical inner pipe 1 in which both end portions are open, from one open end, as shown in Fig. 2A. In this case, although an illustration is omitted, a catalyst holding mat made of ceramics is inserted between the inner pipe 1 and the catalyst carrier 2.

Next, the taper-like reduced diameter portions 1b and 1c are formed by reducing both end portions of the inner pipe 1 in accordance with a reducing process as shown in Fig. 2B. Further, the cylindrical connection portions 1d and 1e are formed in the front portion thereof.

Then, the cylindrical outer pipe 3 in which a diameter thereof is larger than the outer diameter of the inner pipe 1 and both end portions thereof is open is fitted onto the outer periphery of the inner pipe 1 as shown in Fig. 2C. At this time, the heat insulating member (the heat insulating mat) 5 is interposed between the inner pipe 1 and the outer pipe 3 as shown in Fig. 2C if necessary.

Next, as shown in Fig. 2D, in a spinning machine structured such that inner pipe supporting devices 6 and 7 and an outer pipe supporting device 8

are coaxially provided so as to be rotated in the same direction at the same speed in connection therewith, the inner pipe supporting devices 6 and 7 are fitted into reduced both end bore portions of the inner pipe 1 so as to support the inner pipe 1, and the outer periphery of the center portion of the outer pipe 3 is supported in such a manner as to be coaxial with the inner pipe 1 by the outer pipe supporting device 8. Accordingly, even in the case that the heat insulating member 5 is not provided, an annular gap 4 having a predetermined size can be held between the inner and outer pipes 1 and 3.

Then, both end portions of the outer pipe 3 are reduced so as to be plastically deformed by the spinning roller 9, whereby the taper-like reduced diameter portions 3b and 3c are formed. At this time, by positioning with reference to the both end bore portions of the inner pipe 1, it is possible to deform the taper-like reduced diameter portions 3b and 3c of the outer pipe 3 so as to preciously keep the gap 4a with respect to the taper-like reduced diameter portions 1b and 1c of the inner pipe 1, and it is possible to dispose the bore portions along the bore portions of the inner pipe 1.

Further, the front portions of both taper-like reduced diameter portions 3b and 3c in the outer pipe 3 are pressed by the spinning roller 9 so as to be pressed to the outer peripheral surfaces of the

connection portions 1d and 1e in the inner pipe 1 and plastically deformed, and the inner and outer pipes 1 and 3 are integrally structured by connecting the pressed connection portions 3d and 3e to the connection portions 1d and 1e of the inner pipe 1.

In accordance with the producing method mentioned above, the side gap 4a is also provided in the taper-like reduced diameter portion corresponding to the cone portion, the side gap 4a is communicated with the center gap 4, and a contact portion between the inner and outer pipes 1 and 3, that is, a heat transmitting portion is placed at a position far apart from the catalyst carrier 2 in an axial direction. Accordingly, a heat insulating characteristic due to the gaps 4 and 4a is made higher than that of the structure shown in Fig. 9, and a desired heat insulating effect can be obtained. Further, a heat insulating effect can be further increased by interposing the adiabatic member 5.

Figs. 3A to 3D show an embodiment structured such that a damper member, for example, a wire mesh 10 made of a metal small wire is interposed between the inner and outer pipes 1 and 3 at a position corresponding to both axial end portions of the catalyst carrier 2, in place of the heat insulating member (the heat insulating mat) 5 mentioned above, as shown in Fig. 3C. The other structures and producing methods are the same as those mentioned above.

In accordance with the embodiment, the damper member 10 can prevents the inner pipe 1 and the outer pipe 3 from being brought into contact with each other due to vibration.

Figs. 4A to 4E show an embodiment structured such that a member evanished due to heating, for example, a supporting member 11 made of a paper or the like is interposed in place of the damper member 10. The other structures and producing methods are the same as those mentioned above.

In accordance with the embodiment, the outer pipe 1 can be held at the position having a predetermined gap by the supporting member 11 at the production time explained in Figs. 2A to 2D mentioned above, and the supporting member 11 is carbonized and evanished by heating after production, so that the gap with which the central gap 4 and both side gaps 4a are communicated are formed as shown in Fig. 4E.

Fig. 5 shows an embodiment structured such that a damper member, for example a wire mesh 12 made of a metal small wire is interposed between the connection portions 1d and 3d, and 1e and 3e (only the 1e and 3e side is shown in Fig. 5). That is, a step portion 13 due to drawing is formed at a position shown in Fig. 5 of the connection portions 1d and 1e of the inner pipe 1, a step portion 14 due to drawing is formed at a position shown in Fig. 5 of the connection portions 3d and 3e of the outer pipe 3, and the wire

mesh 12 is interposed between the step portions 13 and 14.

In accordance with the present embodiment, it is possible to prevent the inner pipe 1 and the outer pipe 3 from being brought into contact with each other due to vibration by the damper member 12 and it is possible to prevent the damper member 12 from falling out by the step portions 13 and 14. Further, as shown in Fig. 5, by forming the inner pipe 1 and the outer pipe 3 so that they can relatively slide in an axial direction, it is possible to intend to reduce a stress due to a difference of thermal expansion caused by a temperature difference between the inner pipe 1 and the outer pipe 3, whereby it is possible to improve a durability.

In each of the embodiments mentioned above, both end portions of the outer pipe 3 are reduced in accordance with the spinning process after the outer pipe is fitted on the inner pipe. However, the structure may be made such that one end portion of the outer pipe 3 is previously reduced in accordance with the spinning process, the inner pipe 1 having reduced both end portions is inserted from another end portion which is not reduced, whereby the outer pipe is fitted on the inner pipe, and thereafter, another end portion of the outer pipe 3 is reduced in accordance with the spinning process.

Figs. 6A to 6C show an embodiment for

producing parts in an exhaust system in which, with respect to an axis X1 of the connection portions 1d and 3d of one end portion A in the inner pipe 1 and the outer pipe 3, an axis X2 of the connection portions 1e and 3e of another end portion B is eccentric at a predetermined amount.

In producing steps of the embodiment, at first, as shown in Fig. 6A, the taper-like reduced diameter portions 1b and 1c and the cylindrical connection portions 1d and 1e are continuously reduced and formed in both end portions of the center portion 1a in the inner pipe, and there is formed the inner pipe 1 structured such that the axis X2 of the taper-like reduced diameter portion 1c and the connection portion 1e in the another end portion is eccentric at a predetermined amount OF with respect to the axis X1 of the taper-like reduced diameter portion 1b and the connection portion 1d in the one end portion A.

The outer pipe 1 which is not reduced is supported by the supporting device on the outer periphery of the inner pipe 1 supported by the supporting device so as not to rotate, in such a manner as not to rotate with the predetermined gap 4 therebetween, so as to fit the outer pipe on the inner pipe.

In this embodiment, the spinning roller 9 is structured such that a plurality of spinning rollers 9 (two spinning rollers are shown in the illustrated embodiment) are arranged in a peripheral direction

around the axis X1, and each of the spinning rollers 9 can rotate on its own axis, revolves around the axis X1 and moves in a direction perpendicular to the axis X1 and the axial direction.

Accordingly, on the outer peripheral surface of the one end portion A, the spinning roller 9 revolving around the axis X1 is moved in a centripetal direction and the direction of the axis X1 so as to form the taper-like reduced diameter portion 3b and the cylindrical connection portion 3d fitted to each other with a predetermined gap 4a on the outer periphery of the taper-like reduced diameter portion 1b and the connection portion 1d as shown in Fig. 6A.

Next, as shown in Fig. 6B, the reducing process at a predetermined amount as shown in Fig. 6B is performed by coinciding the axis X2 of the connection portion 1e of the inner pipe 1 in the another end portion B with the axis of revolution of the spinning roller 9 and moving the spinning roller 9 revolving around the outer peripheral surface of the another end portion B of the outer pipe 3 in the centripetal direction and the direction of the axis X2. The taper-like reduced diameter portion 3c of the another end portion B of the outer pipe 3 is finally reduced and formed in the outer peripheral portion of the taper-like reduced diameter portion 1c of the inner pipe 1 with the predetermined gap 4a and the connection portion 3e is reduced and formed in the outer

peripheral portion of the connection portion 1e of the inner pipe 1 with the predetermined gap as shown in Fig. 6C by repeating the steps at one or more times.

Accordingly, there can be obtained the parts in the exhaust system in which the axis X2 of the connection portions 1e and 3e of the another end portion B is eccentric with respect to the axis X1 of the connection portions 1d and 3d of the one end portion A in the inner pipe 1 and the outer pipe 3 at the predetermined amount OF, as shown in Fig. 6C.

In this case, the supporting devices of the inner pipe 1 and the outer pipe 3 are omitted.

Figs. 7A to 7C show an embodiment for producing parts in an exhaust system in which, with respect to an axis X1 of the connection portions 1d and 3d of one end portion A in the inner pipe 1 and the outer pipe 3 in the parts in the exhaust system shown in Figs 6A to 6C, an axis X2 of the connection portions 1e and 3e is bent at a predetermined angle.

In producing steps of the embodiment, at first, as shown in Fig. 7A, the taper-like reduced diameter portions 1b and 1c and the cylindrical connection portions 1d and 1e are continuously formed in both end portions of the center portion 1a in the inner pipe, and there is formed the inner pipe 1 structured such that the axis X2 of the taper-like reduced diameter portion 1c and the connection portion 1e in the another end portion is oblique at a predetermined

angle θ with respect to the axis X1 of the taper-like reduced diameter portion 1b and the connection portion 1d in the one end portion A.

Next, as well as Fig. 6A, the outer pipe 3 which is not reduced is fitted on the inner pipe 1, the inner and outer pipes 1 and 3 are supported so as not to rotate, and the one end portion A thereof is reduced by the spinning roller 9 in the same manner as mentioned above, as shown in Fig. 7A.

Then, the outer pipe 3 into which the inner pipe 1 is fitted is set so that the axis X1 thereof is oblique at a predetermined angle θ2 with respect to an axis X3 of revolution of the spinning roller 9, and a reducing process is performed at a predetermined amount, as shown in Fig. 7B, by moving the spinning roller 9 revolving around the axis X3 on the outer peripheral surface of the another end portion B of the outer pipe 3 in the centripetal direction and the direction of the axis X3.

Next, the inner and outer pipes 1 and 3 are further rotated around a center portion O thereof from a state in Fig. 7B, and as shown in Fig. 7C, the spinning process is performed by coinciding the axis X2 of the connection portion 1e of the another end portion B in the inner pipe 1 with the axis X3 of revolution of the spinning roller 9 as shown in Fig. 7C, and the taper-like reduced diameter portion 3c of the another end portion B in the outer pipe 3 is reduced and formed

in the outer peripheral portion of the taper-like reduced diameter portion 1c in the inner pipe 1 with a predetermined gap 4a as shown in Fig. 7C, and the connection portion 3e is reduced and formed in the outer peripheral portion of the connection portion 1e in the inner pipe 1 with a predetermined gap.

Accordingly, there can be obtained the parts in the exhaust system in which the axis X2 of the connection portions 1e and 3e of the another end portion B is oblique at the predetermined angle θ1 with respect to the axis X1 of the connection portions 1d and 3d of the one end portion A in the inner pipe 1 and the outer pipe 3, as shown in Fig. 7C.

In this case, in the embodiments shown in Figs. 6A to 6C and Figs. 7A to 7C, the compressed both end portions of the formed inner pipe 1 and outer pipe 3 are connected to the inner and outer pipes such as a connected double exhaust pipe or the like, whereby the gaps 4 and 4a between the inner pipe 1 and the outer pipe 3 can be kept.

Further, in the embodiments in Figs. 6A to 6C and Figs. 7A to 7C, the connection portions 3d and 3e of the outer pipe 3 may be bonded to the connection portions 1d and 1e of the inner pipe 1.

INDUSTRIAL APPLICABILITY

As mentioned above, in accordance with the present invention, since the structure is made such

that the portions to be reduced in both end portions of the outer pipe are formed by reducing them in accordance with the spinning process, it is possible to easily form the parts in the exhaust system in which both end portions are reduced to the outer periphery of the inner pipe in which both end portions are reduced so as to bond the reduced diameter ends of the outer pipe to the reduced diameter ends of the inner pipe or to be apart the former from the latter and the gap is formed between the inner pipe and the outer pipe all along both reduced diameter portions of the outer pipe. Further, it is possible to integrally form the outer pipe with no joints not only in a whole length in the axial direction thereof but also in the peripheral direction.

Further, since the inner pipe and the outer pipe can be bonded to each other by a plastic deformation in accordance with the spinning process, the inner pipe and the outer pipe can be connected without using a welding process or a pressing process.

Further, a heat insulating performance can be improved by interposing the heat insulating member in the gap between the inner and outer pipes. Further, it is possible to prevent the inner pipe and the outer pipe from being brought into contact with each other due to vibration by interposing the damper member.

Further, in accordance with the producing method including the step of fitting the outer pipe on

the outer side of the inner pipe containing the catalyst carrier in the center portion and having the substantially taper-like reduced diameter portions formed in both end portions of the center portion while holding the gap, and the step of applying the spinning process in such a manner as to have the gap between both end portions of the outer pipe and the reduced diameter portion in the inner pipe so as to reduce both end portions of the outer pipe in the substantially taper shape, the parts in the exhaust system mentioned above can be easily produced.

Furthermore, by producing the parts in the exhaust system in such a manner as to interpose one of the heat insulating member and the damper member in at least a part between the inner pipe and the outer pipe at a time of fitting the outer pipe on the inner pipe, it is possible to easily produce the parts in the exhaust system in which the heat insulating member or the damper member is interposed within the gap.

CLAIMS

1. Parts in an exhaust system comprising:

an inner pipe containing a catalyst carrier in a center portion and having substantially taper-like reduced diameter portions formed in both end portions of the center portion; and

an outer pipe having substantially taper-like reduced diameter portions integrally formed in both end portions of a center portion corresponding to the center portion of said inner pipe and provided on an outer periphery of the inner pipe in such a manner as to have a gap between the outer pipe and said inner pipe all along an area including the reduced diameter portions in both end portions and the center portion,

wherein the reduced diameter portions in both end portions of said outer pipe are formed in accordance with a spinning process.

2. Parts in an exhaust system as claimed in claim 1, wherein one of a heat insulating member and a damper member is interposed in at least a part within said gap.

3. A method of producing parts in an exhaust system comprising the steps of:

fitting an outer pipe on an outer side of an inner pipe containing a catalyst carrier in a center portion and having substantially taper-like reduced diameter portions formed in both end portions of the center portion with holding a gap therebetween; and

applying a spinning process in such a manner as to have a gap between both end portions of the outer pipe and the reduced diameter portion in said inner pipe so as to reduce both end portions of the outer pipe in a substantially taper shape.

4. A method of producing parts in an exhaust system as claimed in claim 3, wherein one of a heat insulating member and a damper member is interposed in at least a part between the inner pipe and the outer pipe at a time of fitting said outer pipe on the inner pipe.

ABSTRACT

In order to easily and inexpensively produce parts in an exhaust system in which a gap is formed in series to both of taper-like reduced diameter portions of inner and outer pipes, in the parts in the exhaust system having an inner pipe containing a catalyst carrier in a center portion and having substantially taper-like reduced diameter portions formed in both end portions of the center portion, and an outer pipe having substantially taper-like reduced diameter portions integrally formed in both end portions of a center portion corresponding to the center portion of the inner pipe and provided on an outer periphery of the inner pipe in such a manner as to have a gap all along the area including the reduced diameter portions in both end portions and the center portion, the reduced diameter portions in both end portions of the outer pipe are formed in accordance with a spinning process. Further, in order to produce the parts in the exhaust system, a producing method includes a step of fitting an outer pipe on an outer side of an inner pipe containing a catalyst carrier in a center portion and having substantially taper-like reduced diameter portions formed in both end portions of the center portion with holding a gap therebetween, and a step of applying a spinning process in such a manner as to have a gap between both end portions of the outer pipe and the reduced diameter portion in the inner pipe so as to

reduce both end portions of the outer pipe in a substantially taper shape.

FIG. 1A

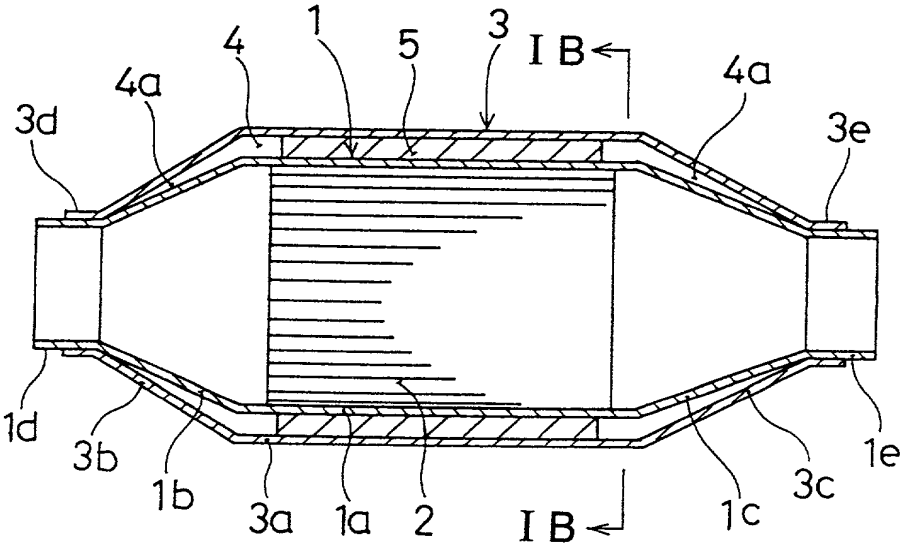


FIG. 1B

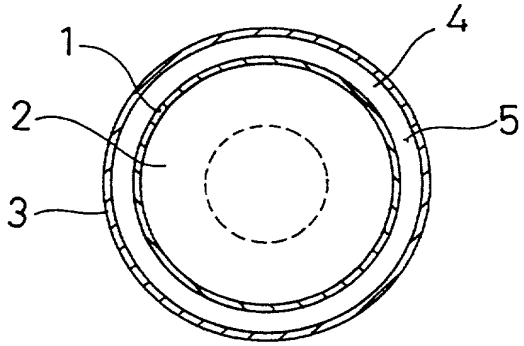


FIG. 2A

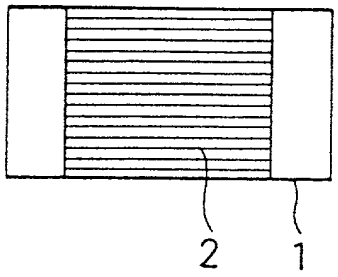


FIG. 2B

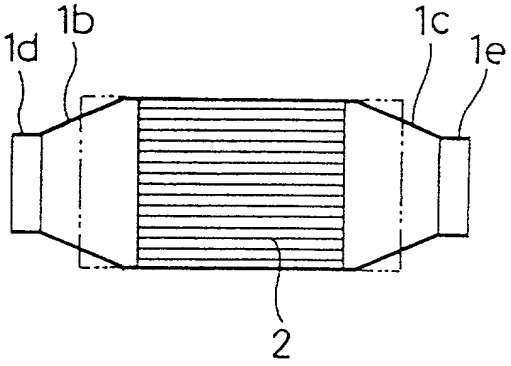


FIG. 2C

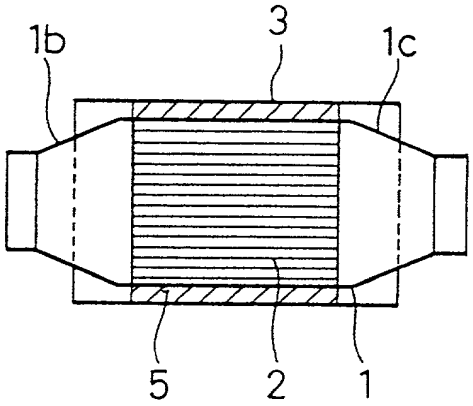


FIG. 2D

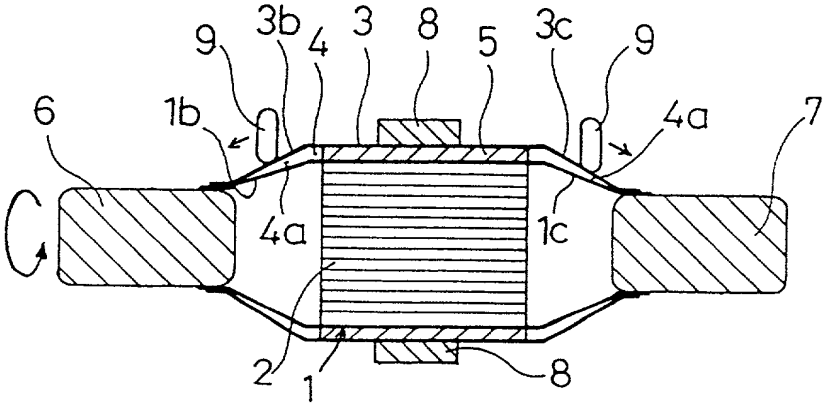


FIG. 3A

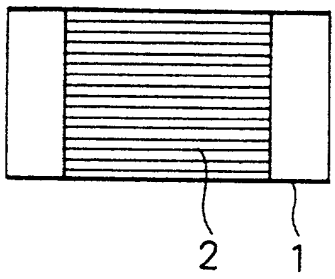


FIG. 3B

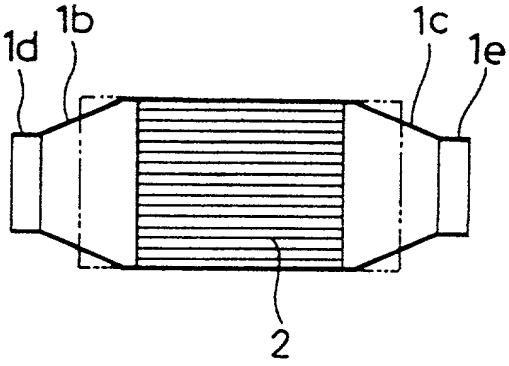


FIG. 3C

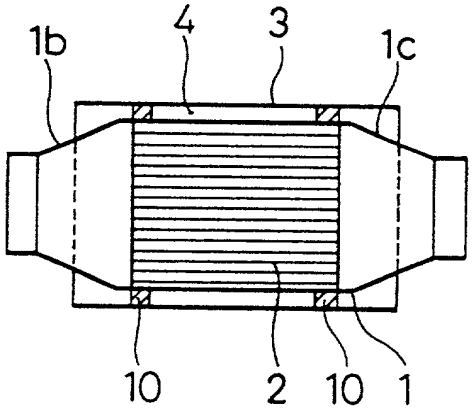


FIG. 3D

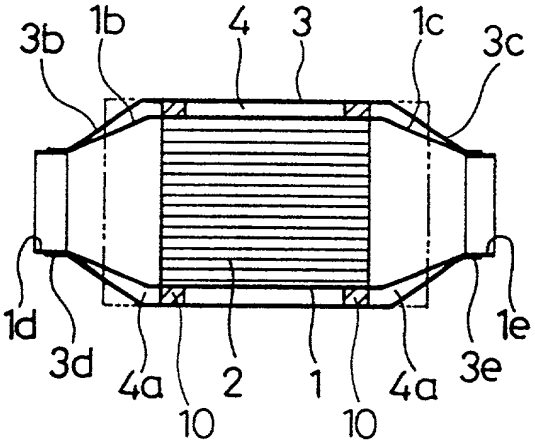


FIG. 4A

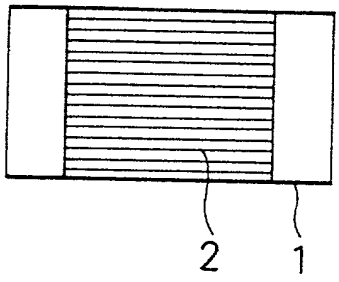


FIG. 4B

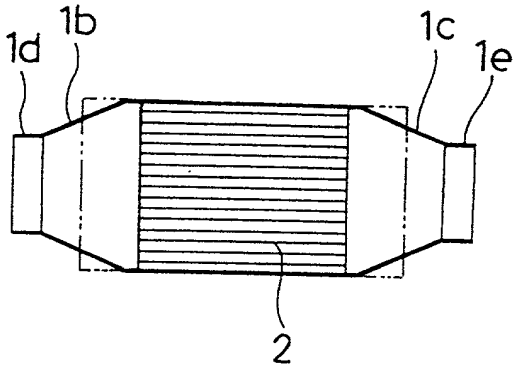


FIG. 4C

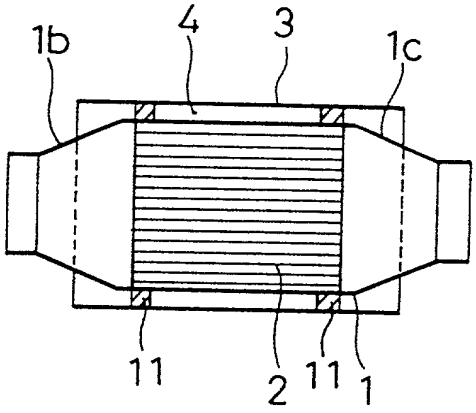


FIG. 4D

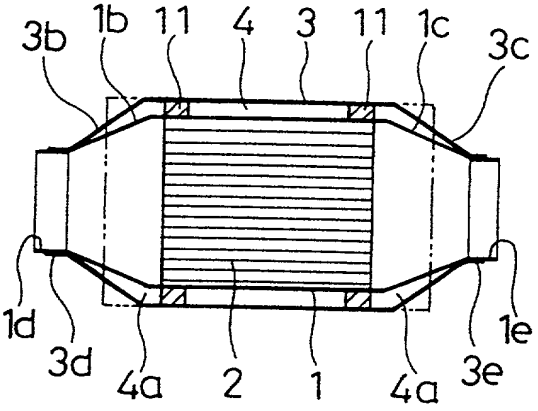


FIG. 4E

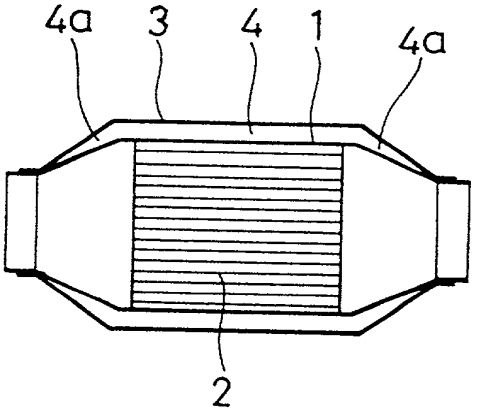


FIG. 5

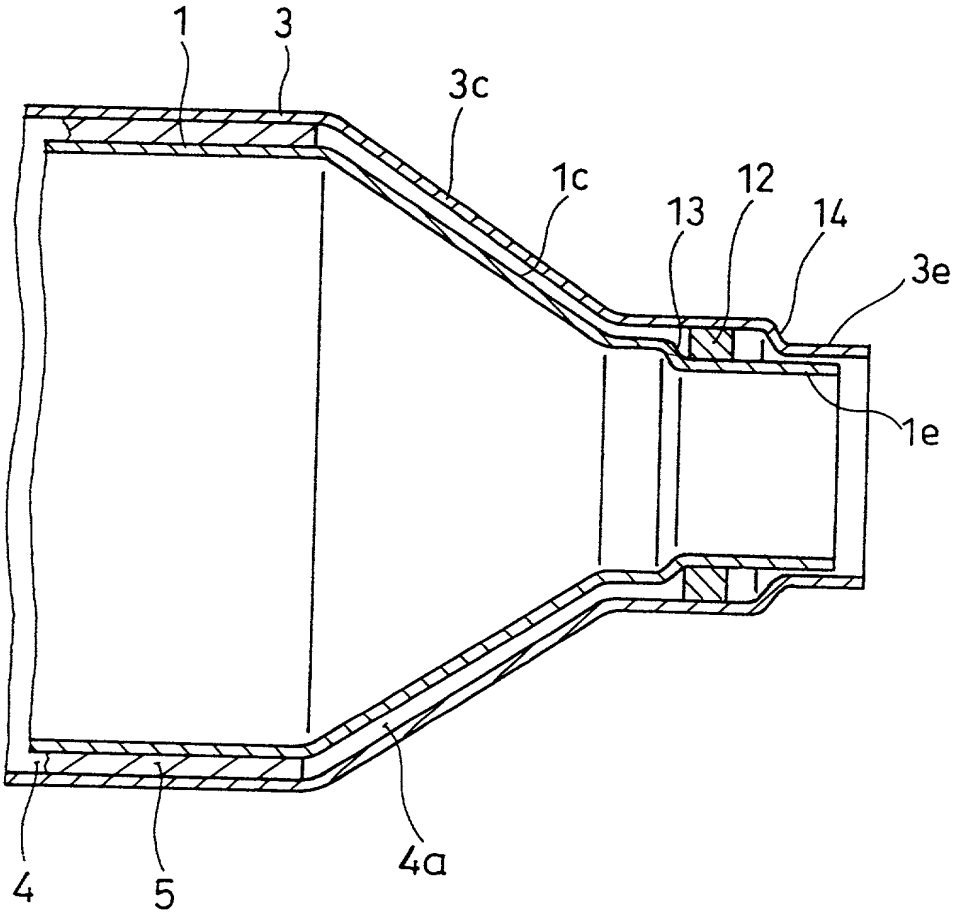


FIG. 6A

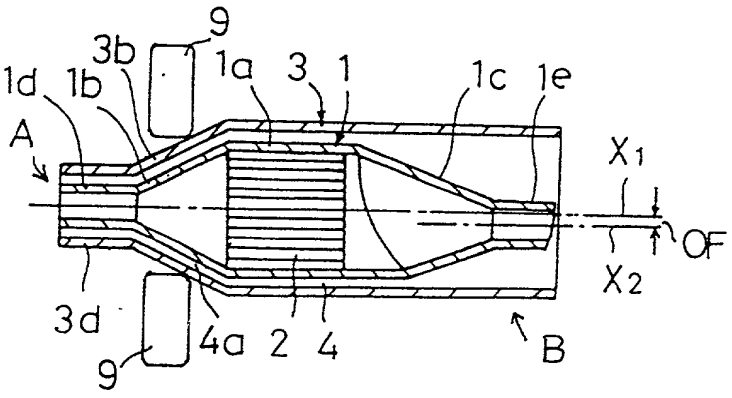


FIG. 6B

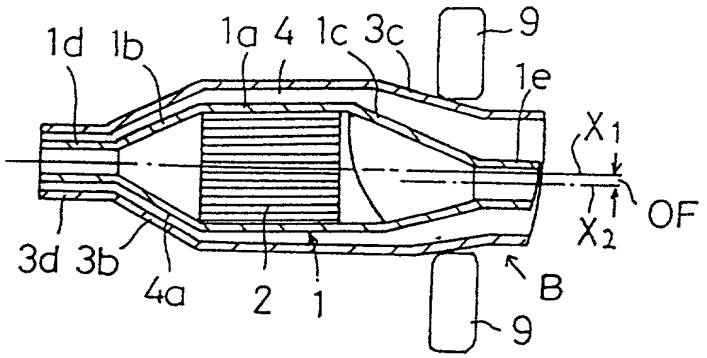


FIG. 6C

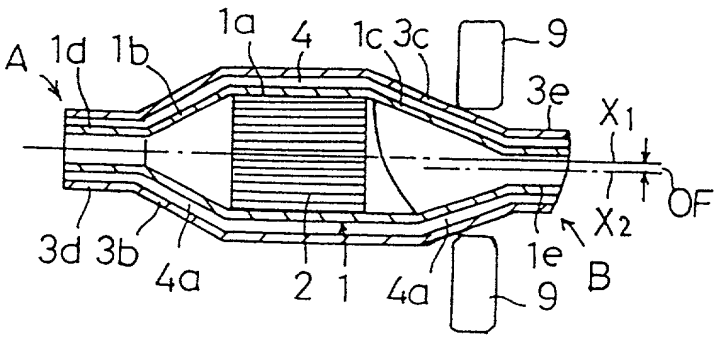


FIG. 7A

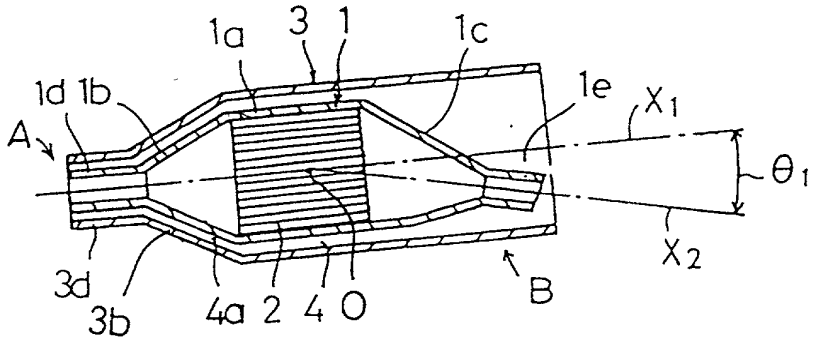


FIG. 7B

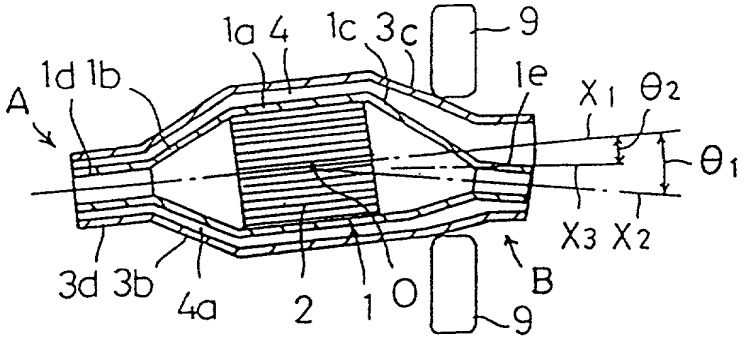


FIG. 7C

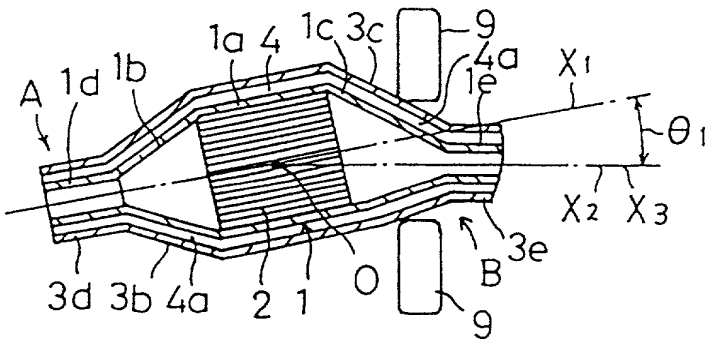


FIG. 8

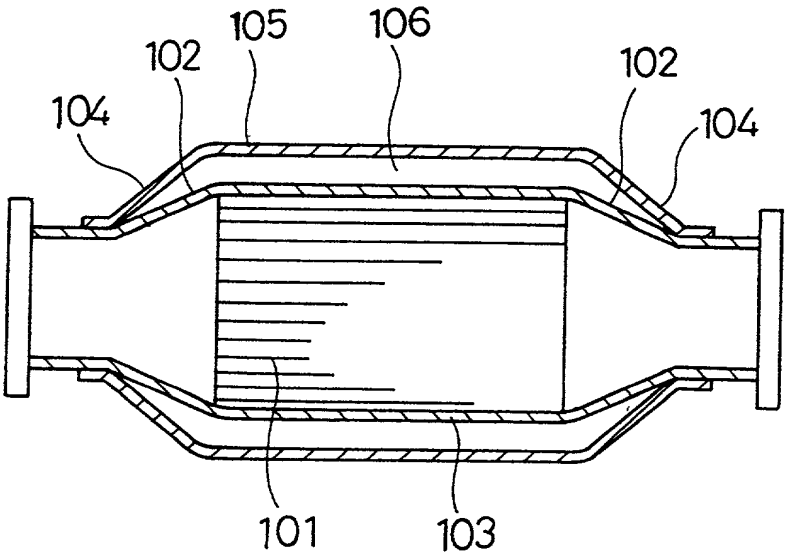
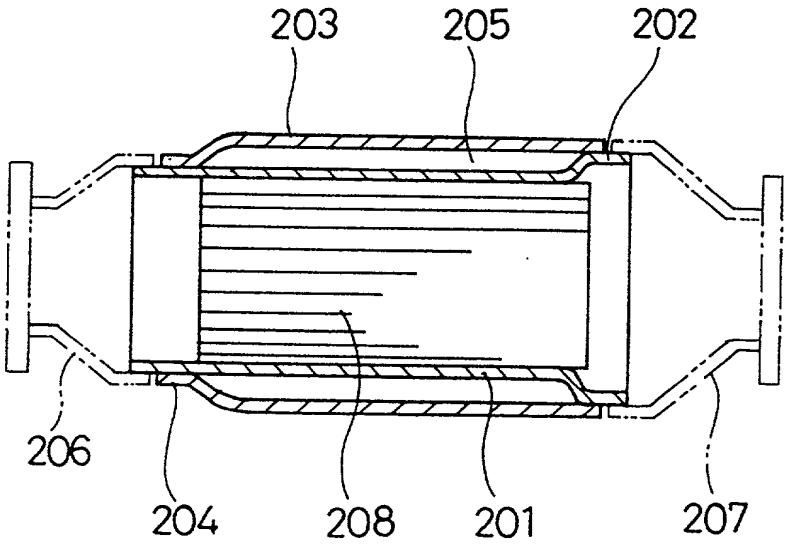


FIG. 9



E-1629-01 (*)

FOR UTILITY/DESIGN
CIP/PCT NATIONAL/PLANT
ORIGINAL/SUBSTITUTE/SUPPLEMENTAL
DECLARATIONS

RULE 63 (37 C.F.R. 1.63)
DECLARATION AND POWER OF ATTORNEY
FOR PATENT APPLICATION
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

PM & S
FORM

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name, and I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the INVENTION ENTITLED "PARTS IN EXHAUST SYSTEM AND METHOD OF PRODUCING THE SAME"
the specification of which (CHECK applicable BOX(ES))

X A. ☐ is attached hereto.

BOX(ES) → B. ☐ was filed on _____ as U.S. Application No. _____ /

→ → C. ☒ was filed as PCT International Application No. PCT/ JP99 / 02739 on May 25, 1999

and (if applicable to U.S. or PCT application) was amended on March 10, 2000 (PCT Art 34)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose all information known to me to be material to patentability as defined in 37 C.F.R. 1.56 Except as noted below, I hereby claim foreign priority benefits under 35 U.S.C 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT International Application which designated at least one other country than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate, or PCT International Application, filed by me or my assignee disclosing the subject matter claimed in this application and having a filing date (1) before that of the application on which priority is claimed, or (2) if no priority claimed, before the filing date of this application:

PRIOR FOREIGN APPLICATION(S) Number	Country	Day/MONTH/Year Filed	Date first Laid-open or Published	Date Patented or Granted	Priority NOT Claimed
10-146760	Japan	28 May, 1998			

If more prior foreign applications, X box *at bottom* and continue on attached page.

Except as noted below, I hereby claim domestic priority benefit under 35 U.S.C 119(e) or 120 and/or 365(c) of the indicated United States applications listed below and PCT international applications listed above or below and, if this is a continuation-in-part (CIP) application, insofar as the subject matter disclosed and claimed in this application is in addition to that disclosed in such prior applications, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in 37 C.F.R 1.56 which became available between the filing date of each such prior application and the national or PCT international filing date of this application:

PRIOR U.S. PROVISIONAL, NONPROVISIONAL AND/OR PCT APPLICATION(S) Application No. (series code/serial no.)	Day/MONTH/Year Filed	Status pending, abandoned, patented	Priority NOT Claimed

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

And I hereby appoint Pillsbury Madison & Sutro LLP, Intellectual Property Group, 1100 New York Avenue, N.W., Ninth Floor, East Tower, Washington, D.C. 20005-3918, telephone number (202) 861-3000 (to whom all communications are to be directed), and the below-named persons (of the same address) individually and collectively my attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith and with the resulting patent, and I hereby authorize them to delete names/numbers below of persons no longer with their firm and to act and rely on instructions from and communicate directly with the person/assignee/attorney/firm/ organization who/which first sends/sent this case to them and by whom/which I hereby declare that I have consented after full disclosure to be represented unless/until I instruct the above Firm and/or a below attorney in writing to the contrary

Paul N. Kokulis	16773	Paul E. White, Jr.	32011	Stephen C. Glazier	31361	Adam R. Hess	41835
~~Raymond F. Lippitt~~	~~17648~~	Glenn J. Perry	28458	~~Ruth N. Mordush~~	~~24044~~	William P. Atkins	38821
G. Lloyd Knight	17698	Kendrew H. Colton	30368	Richard H. Zaitlen	27248	Paul L. Sharer	36004
Kevin E. Joyce	20508	G. Paul Edgell	24238	Roger R. Wise	31204		
George M. Sirilla	18221	Lynn E. Eccleston	35861	~~Jay M. Finkelstein~~	~~21082~~		
Donald J. Bird	25323	Timothy J. Klima	34852	Michael R. Dzwonczyk	36787		
Peter W. Gowdey	25872	David A. Jakopin	32995	W. Patrick Bengtsson	32456		
Dale S. Lazar	28872	Mark G. Paulson	30793	Jack S. Barufka	37087		

(1) INVENTOR'S SIGNATURE: Michio Morishita Date: November 1, 2000

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	City	State/Foreign Country	Country of Citizenship

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(2) INVENTOR'S SIGNATURE: Date:

First	Middle Initial	Family Name

Residence			
	City	State/Foreign Country	Country of Citizenship

Post Office Address	
(include Zip Code)	

FOR ADDITIONAL INVENTORS, "X" box ☐ and proceed on the attached page to list each additional inventor.

☐ See additional foreign priorities on attached page (incorporated herein by reference).

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